Research on the value of medical library services: does it make an impact in the health care literature?*

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Objective: To evaluate the impact in the health care literature of research articles that provided evidence of the value of library services (including MEDLINE) as an element of quality health care.

Data Sources/Selection: Four research articles on the relationship between use of library services and quality health care were selected as ''primary articles'' from a MEDLINE search using appropriate Medical Subject Heading. Primary articles met the following criteria: written in English, reported research, related to clinical care, and published before 1995.

Data Extraction: The technique of citation analysis was used to measure the impact of the primary articles on the subsequent literature. The number, authorship, type, and publication venue of articles citing the primary articles were determined using ISI Web of Science, MEDLINE, other electronic resources, and the citing articles themselves. For the 146 English-language citing articles, the article type (i.e., advocacy, instructional, research) was noted; and, for those that reported research, the use to which the author put the cited material was determined.

Results: The primary articles were cited more often than the average articles published that year in the same journals. At the time of the study each article had been cited almost every year since publication. Of the 146 citing articles written in English, 43% were written by librarians, 38% by physicians, 12% by librarians with physicians. The majority were published in medical journals, followed in order of decreasing frequency by the *Bulletin of the Medical Library Association,* information science journals, and health administration journals.

Conclusions: The results of this study demonstrate that published research on the value of medical library services has an impact on the literature. These articles are read and cited and continue to be of value.

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INTRODUCTION

The current shortage of health care dollars challenges all areas of health care, including medical librarianship, to prove their value to the provision of quality patient care. Managers are expected to provide qualitative and quantitative evidence of their value. This is not a new scenario for hospital librarians. In the mid-1980s, David King published a seminal paper on the contribution of hospital library information services to clinical care [1]. The findings of this study provided the impetus for further research in the area. However, to be of value, these research results must be disseminated and articles reporting the research must reach a wide readership and be referenced in other publications.

We decided to determine if articles related to research on the value of medical library services are meeting these criteria. An initial MEDLINE search was done to identify articles beyond the King study. The search was limited to MEDLINE because of its almost universal availability for medical librarians and to investigate its utility or limitations in identifying this type of study.

We used citation analysis to determine how often this research was cited by other articles. We reviewed the articles that cited this research to determine who used the research, where they published, and how they used the information in the articles. The results of this study raise interesting questions for future research and add to our knowledge of publication patterns for medical librarians.

METHODS

Data selection

The search to identify articles began with the analysis of the MeSH terms associated with the King article. Articles retrieved using these terms were again analyzed to develop the search strategy. The search performed in MEDLINE (May 2001) used the simple (no explosion) MeSH terms ''MEDLINE/utilization or libraries, hospital/utilization or information services/utilization'' combined (AND) with the simple (no explosion) MeSH terms ''quality of health care'' or ''decision making'' or ''treatment outcome'' or ''hospital costs.'' We limited the search to English-language articles and selected for inclusion only those that (1) reported research, (2) were related to clinical care, and (3) had been published at least five years previous to the date of the search. The third criterion was considered necessary to allow time for the publication of subsequent articles citing the primary articles.

Using ISI's Web of Science database, we generated a list of articles that cited at least one of the primary articles. This list included the article citation, data type, and language of each ''citing article.'' We obtained country of publication of each of the journals containing the citing articles via MEDLINE or other electronic resources, and the author's profession and country of affiliation using the same electronic resources or the articles themselves, when necessary.

Data analysis

We transferred the data to ProCite and Excel databases. For our analysis of these data, we relied on the technique of citation analysis. Pioneered by Eugene Garfield and the Institute for Scientific Information (ISI), this technique involves counting the number of times an article has been cited in the literature (citation frequency) to determine that article's impact [2]. Garfield and others have identified this impact measure as an indication of an article's value [3] and its impact and influence on the field [4–6]. Further, a review of the annual citation frequencies for an article can reveal the speed at which a paper becomes influential and provide an estimate of its future potential [7]. The lag between an article's date of publication and the time at which it begins to demonstrate a significant citation frequency can reflect how long it took others in the field to learn about the article and incorporate it in their work. Articles that are cited frequently over long periods of time may qualify as classics [8].

According to Garfield, however, citation analysis should not consist of mere citation counting. He suggests the need for content and context analysis as well [9]. In the current study, in addition to calculating citation frequencies, we used the following categories, derived in part from Zachert [10], to characterize the purpose of the English-language citing articles.

- *Advocacy:* articles discussing or arguing for the importance of health sciences libraries
- *Instructional:* how-to articles that explain such things as how to use the Internet, search the medical literature, or understand evidence-based medicine.
- *Research:* any inquiry, including case reports, that is carried out, at least in part, by a systematic method with the purpose of eliciting some new data, facts, concepts, or ideas.

We further examined research articles to determine the use to which the authors put the information gleaned from the primary article(s) cited. The following categories were developed:

- *Mention:* mentions primary article, usually in introduction or discussion.
- *Design:* used elements of experimental design similar to those in the primary study or studies.
- *Comparison:* used similar elements of experimental design and compared results of reported study to results of the primary study or studies.

We also categorized the type of journals in which the citing articles were published and the profession of the articles' authors. The journal categories were

- *Bulletin of the Medical Library Association (BMLA):* Because of the large number of citing articles appearing in this journal, it was treated as a separate category.
- *Health administration:* journals directed to health administrators other than librarians or physicians.
- *Information science:* journals directed to librarians or computer scientists not necessarily in the field of health care.

■ *Medical:* journals directed to physicians and dentists. This category includes medical informatics journals and computer-related journals with the words ''Medical,'' ''Medicine,'' or ''MD'' in the title.

The authors were placed in one of three categories by profession:

■ *Librarian:* affiliated with a hospital, government or university library, school of library science, or library association

■ *Physician:* has M.D., D.D.S., or D.O. degree, regardless of place of employment

■ *Other:* none of the above, most often a Ph.D. medical school faculty member, but also includes authors who are nurses, medical students, or work in information systems.

RESULTS

Four articles met the search criteria and became primary articles in this study:

■ King DN. The contribution of hospital library information services to clinical care: a study in eight hospitals. Bull Med Libr Assoc 1987 Oct;75(4):291–330.

■ Marshall JG. The impact of the hospital library on clinical decision making: the Rochester study. Bull Med Libr Assoc 1992 Apr;80(2):169–78.

■ Lindberg DA, Siegel ER, Rapp BA, Wallingford KT, Wilson SR. Use of MEDLINE by physicians for clinical problem solving. JAMA 1993 Jun 23–30;269(24):3124–9.

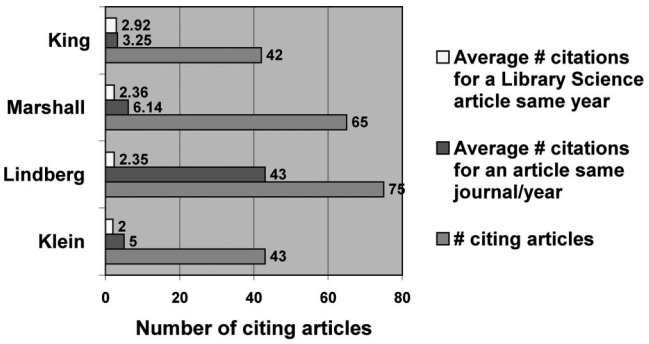
■ Klein MS, Ross FV, Adams DL, Gilbert CM. Effect of online literature searching on length of stay and patient care costs. Acad Med 1994 Jun;69(6):489–95.

The King and Marshall articles report on surveys of library users in Chicago and Rochester, New York, respectively. Lindberg and colleagues report the results of a study commissioned by the National Library of Medicine that used the critical incident techniques as the framework for interviews of 552 MEDLINE users throughout the United States. Klein and colleagues collected the data for their study by reviewing the medical records of medical and surgical inpatients in two Detroit hospitals.

Two of the articles were published in the *Bulletin of the Medical Library Association.* The other articles were published in *Academic Medicine,* which is targeted to medical educators, and *JAMA: The Journal of the American Medical Association,* which is widely read by physicians, health care administrators, and policy makers. These journals have highly divergent publication patterns (quarterly, monthly, and weekly), distribution patterns, and impact.

The ISI Web of Science search retrieved 154 publications that cited one or more of these articles. (See the appendix for a list of these articles.) Of these, 19% cited the King article, 29% the Marshall article, 33% the Lindberg article, and 19% the Klein article; 31% of the citing articles cited more than one of the primary articles. We noted only five instances of self-citation: two by Klein, two by Lindberg, and one by Marshall. Data types included articles (74%), reviews (10%), editorials (7%), letters (7%), a note (1%), and a correction (1%).

Figure 1
Citation frequencies of primary articles compared to other library science articles published the same year or other articles published in the same journal that year

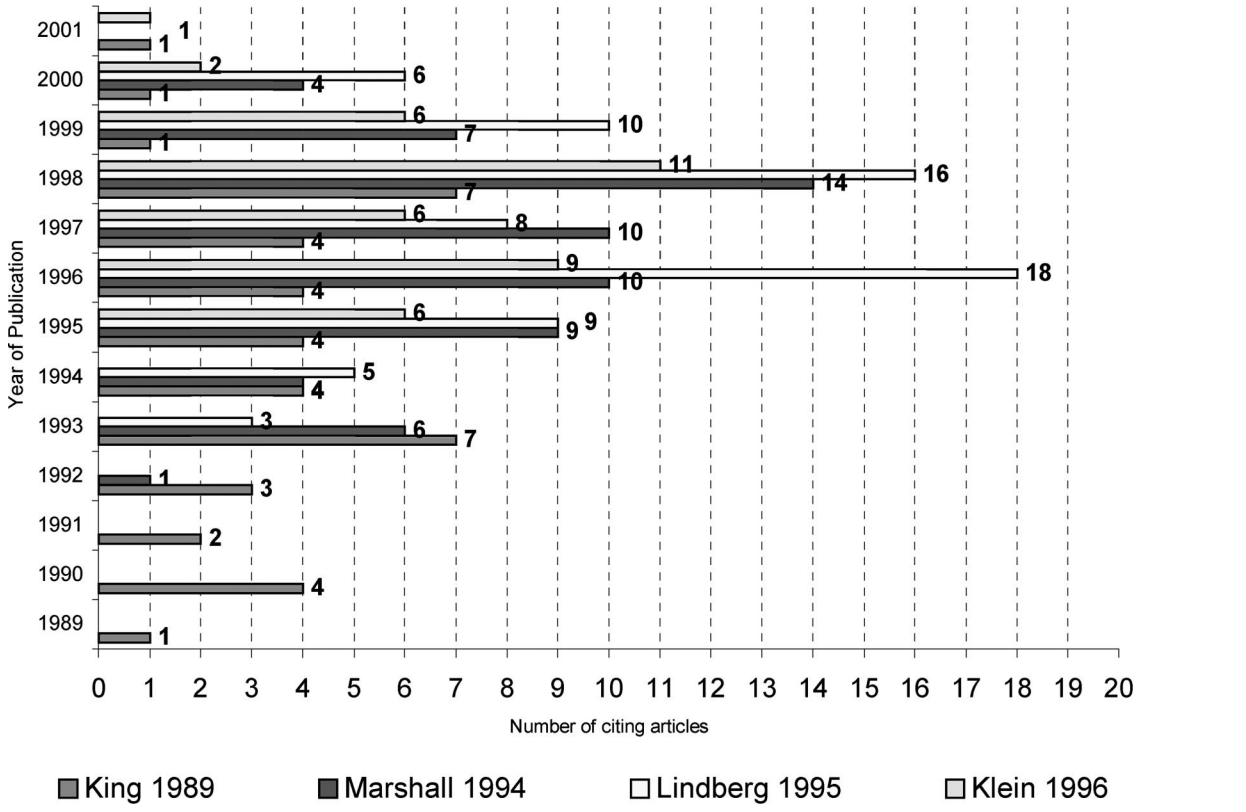


The primary articles evidenced a high impact in that they were cited at a greater frequency than both the average library science article published the same year and the average article published in the same journal that year. The citation frequencies for both the King and the Marshall articles were more than ten times the average frequency for an article published the same year in the *BMLA* (12.9 and 10.6 times, respectively). Klein et al. was cited 8.6 times more often than the average article published in the 1994 volume of *Academic Medicine,* and Lindberg et al. was cited 1.7 times more often than the average article published in *JAMA* in 1993 [11] (Figure 1). Each primary article, with the exception of King's, was cited every year following its year of publication through 2000. The first article citing King appeared two years after publication; King has been continually cited from 1989 through 2001, though less often since 1998 (Figure 2).

The citing articles appeared in 69 different journals published in 10 countries in 4 languages (English, French, German, and Spanish). Over half of the citing articles (57%) were published in medical journals, 29% in *BMLA,* 12% in information science journals, and 2% in health administration journals. All of the foreign language articles appeared in medical journals. One or more of the primary articles were cited in articles in both medical journals and the *BMLA* each year from 1989 through 2000. It may not be surprising that over half the articles citing either Lindberg or Klein appeared in medical journals since the original articles were published in medical journals. More interesting is that almost half of the articles citing Marshall, which was published in *BMLA,* appeared in medical journals. It was only with articles citing King that the majority were published in *BMLA.* This finding attests to the impact of these articles outside the field of medical librarianship (Table 1).

Authors of the citing articles represented seventeen countries; the majority of the articles appeared in journals published in the authors' home countries. Librarians authored 42% of the articles; physicians 31%; others 8%; librarians and physicians or librarians, physicians, and others as coauthor were responsible for

Figure 2
Number of citing articles published by year for each selected article



11%; the remaining 8% were authored by combinations of the remaining groups. Articles authored or coauthored by librarians most often cited King or Marshall. The only articles authored by physicians that cited King were those coauthored with a librarian, but almost 20% of the articles authored only by physicians cited Marshall (Table 2).

Of the citing articles authored only by librarians, 51% appeared in *BMLA,* 23% in medical journals, and 26% in information science journals. Physicians published almost exclusively in medical journals (96%), with only 1 article appearing in *BMLA* and one in an information science journal. Of the articles authored by those in the category ''other,'' 58% were published in medical journals, 25% in *BMLA,* and 1 each in an information science and a health administration journal. Of the articles coauthored by combinations of the various groups, 67% appeared in medical journals, 27% in *BMLA,* and 7% in health administration journals.

Of the 146 English-language citing articles, 27% cited King, 42% cited Marshall, 49% cited Lindberg et al., and 27% cited Klein et al. There was a total of 212 relevant citations in the articles, as some papers cited more than one of the primary studies. The majority of the citing articles reported research. The remainder discussed or argued for the importance of health science libraries (advocacy) or provided how-to or instructional information. Advocacy articles cited Marshall more frequently than they cited the other primary articles (40%). Lindberg was cited most often in both instructional and research articles. Research articles made up the largest percentage of citing articles for each primary article (see Table 3).

The advocacy articles were almost equally divided between *BMLA* and medical journals (37% and 40%, respectively), with the remainder in information science (16%) and health administration (7%) journals. A similar pattern was true of research articles: 43% appeared in *BMLA,* 46% in medical journals, 11% in information science journals, and none in health administration journals. No instructional article citing the primary articles appeared in *BMLA;* most were in medical journals (84%), with 13% in information science journals and 3% in health administration journals.

Table 1
Type of journal publishing citing articles

	King n (%)	Marshall n (%)	Lindberg et al. n (%)	Klein et al. n (%)
Medical	9 (21%)	29 (45%)	53 (71%)	29 (67%)
BMLA	25 (60%)	23 (35%)	13 (17%)	11 (26%)
Information science	7 (17%)	12 (18%)	7 (9%)	2 (5%)
Health administration	1 (2%)	1 (2%)	2 (3%)	1 (2%)

% = # cites to primary article by type of journal/total # cites to primary article.

Table 2
Professional background of authors of citing articles

	King n (%)	Marshall n (%)	Lindberg et al. n (%)	Klein et al. n (%)
Librarian	34 (81%)	37 (57%)	20 (27%)	19 (44%)
Physician	0	12 (18%)	36 (48%)	10 (23%)
Librarian/physician	4 (10%)	7 (11%)	0	5 (12%)
Physician/other	0	2 (3%)	7 (9%)	6 (14%)
Librarian/other	0	1 (2%)	7 (9%)	0
Librarian/physician/other	1 (2%)	2 (3%)	0	1 (2%)
Other	3 (7%)	4 (6%)	5 (7%)	2 (5%)

% = # cites to primary article by type of author/total # cites to primary article.

Librarians authored the majority (60%) of the advocacy articles, followed by physicians (17%), librarians and physicians as coauthors (13%), and physicians and others or others (10%). The majority of the instructional articles were written by physicians or physicians and other nonlibrarians (60%), with librarians authoring 24%, librarians and physicians 5%, and others 11%. Research articles showed the greatest diversity in authorship: librarians wrote 44% of the articles; physicians, 29%; librarians and physicians, 10%; physicians and other nonlibrarians, 6%; others, 6%; librarians, physicians, and others, 4%; and librarians and others, 1%.

The seventy-nine articles reporting research (containing 114 citations) were further reviewed to determine how the citing authors used the referenced information from the primary articles. The majority (56%) merely cited the articles as examples of studies that showed the value of library services; 33% used elements of the research design from the primary articles in their studies; of these, 11% also compared their results to those of the primary articles. Klein et al. was cited in 22% of the research articles, but none of the authors attempted to replicate elements of their study. Though 36% of the research studies relied on King, Marshall, or Lindberg et al. for elements of their experimental design, hardly more than a quarter of them (26%) also compared their results with those of these previous studies. Of those that did make comparisons, 33% looked at results from King, 45% from Marshall, and 22% from both. One of the King citations was in a paper published in 1990, before the publication of Marshall (Table 4).

DISCUSSION

The results of this study may have been limited by the methods used for data selection and extraction. MEDLINE, though vast in coverage, does not contain articles published in the *Bibliotheca Medica Canadiana,* the publication of the Canadian Health Libraries, and has only recently begun indexing *Health Information and Libraries Journal* from the Library Association–Health Libraries Group from the United Kingdom. Likewise, the ISI Web of Science may not retrieve all articles citing the selected research; for instance, an article in the health administration journal *Hospital Topics* [12] that relied heavily on data from the King article was not included in the ISI Web of Science retrieval. Finally, though the Web of Science appears to include nursing literature, it found no articles citing the primary articles in nursing journals. The study also failed to show that the primary articles influenced the health administration literature. This may point out that the ISI Web of Science is a poor source for references in the health administration literature, or it may be an accurate indication of the state of the literature. This apparent lack of references to articles on the value of library services in both the nursing and health administration literature is something that could be explored in future studies.

Further, our search strategy may not have been sufficient to uncover all articles indexed in MEDLINE that are related to the value of library services to clinical care. For example, a report on the Value project by Urquhart and Hepworth [13] meets the criteria used for selecting the primary articles but was not retrieved by

Table 3
Types of articles that cited the four references

Primary articles	Advocacy n (%)	Instructional n (%)	Research n (%)
King	13 (33%)	2 (5%)	24 (62%)
Marshall	20 (32%)	12 (19%)	30 (49%)
Lindberg et al.	7 (10%)	23 (32%)	41 (58%)
Klein et al.	10 (25%)	11 (27%)	19 (48%)

% = # cites to primary article by type of citing article/total # cites to primary article in English-language articles.

Table 4
Use of the information in the primary article by authors of research articles

	King n (%)	Marshall n (%)	Lindberg et al. n (%)	Klein et al. n (%)
Example	8 (33%)	19 (63%)	26 (63%)	17 (100%)
Design	11 (46%)	5 (17%)	15 (37%)	0
Comparison	5 (21%)	6 (20%)	0	0

% = # cites to primary article by use of the information in the citing article/total # cites to primary article in English-language research articles.

the search. To maintain methodological integrity, we did not include this article in the evaluation.

It might also be argued that the impact of the articles by King and Marshall was artificially influenced by the actions of the Medical Library Association. These papers were the subject of an MLA publicity campaign that included the publication of a Fact Sheet shortly after the publication of the Marshall paper, the text of which is still available on the MLA Website.† The papers are the number 1 (Marshall) and 2 (King) most cited articles published in *BMLA* in the last thirty years [14], supporting the suggestion that the MLA did in fact work to create ''hot papers'' for its publication [15]. Of course, these same efforts may also be responsible for the twenty-three published research studies and the untold number of unpublished repetitions that were developed using methodology influenced by the King and Marshall articles. Perhaps to have a real impact, the results of research about the value of medical library services must receive wider dissemination than simple publication in a journal, and MLA should be encouraged to publicize such results wherever they are published.

According to our findings, the impact of the primary articles was very far reaching, with authors publishing outside of the United States and outside of the medical library profession using the information in some way. Librarians as sole authors were responsible for less than half the articles. As the librarian group contained both health science librarians and academic or other librarians, it might be expected that the articles would appear equally in both the *BMLA* and other information science journals. Most interesting, however, is that nearly one-fourth of the articles appeared in medical journals. Librarians coauthored seventeen (11%) of the articles with physicians. Though this may appear to be a small percentage, it does show that collaboration is taking place.

The finding that most advocacy articles were written by librarians was not unexpected. However, it is satisfying that 40% of such articles appeared in medical journals. Less satisfying is the fact that almost twice the numbers of instructional articles were written by physicians (16) than by librarians (9). While end-user searching is a goal of many librarians and health care professionals, does this finding indicate that we mean to abdicate our responsibility to ensure the quality of instruction? Or is it merely a reflection of the greater publication rate of physicians? Evidence exists that the medical literature will support articles on instruction. We would argue that librarians should be authoring the majority of these.

CONCLUSION

Does writing on the value of medical library services make an impact? Does anyone read articles on this topic? Should we continue to write them? Should we encourage others to research and write on this topic? Based upon this study, the answer to all of those questions is an unequivocal ''yes.'' Such research does have an impact.

In our research we looked at how other authors cited these four specific articles and the various characteristics of the articles that cited them. Our question focuses upon whether research on the value of library services to clinical care is noticed and used by other authors and researchers. We have attempted to evaluate the efficacy of citation analysis for this purpose. The subtle goal of this research is to encourage further research into the value of medical library services to clinical care and decision making. We encourage this because authors writing in a variety of disciplines and countries use the material; these articles are cited longer and more often than other articles published in the same journals in the same year.

These findings have implications for future authors and researchers. We recommend that the area of health administration and nursing be investigated to determine if the failure to locate articles in these areas was a limitation of the tools used. If that is not the case then medical librarians should consider publication in these venues.

† The Value of the Hospital Library may be viewed at http://www.mlanet.org/resources/value.html.

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APPENDIX

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Addendum

Citing articles added to the ISI Web of Science between May 2001 and August 2002. These citations are presented for informational purposes. They are not included in the citation analysis.

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